



Energy Storage Innovation

Research, Development, and Demonstration Essential to California's Clean Energy Future

Energy Storage: The Basics

California's power grid delivers electricity to millions of people continuously as it is generated. In an electric system powered mainly by fossil fuels, advanced storage technologies played a limited role. However, energy from renewable sources like solar and wind cannot be stored in a barrel or tank, and its generation does not always align with demand. Energy storage fills the gap between when electricity is generated and when it must be used. It gives the grid power to transcend its instantaneous nature and support a clean, flexible, and predictable energy future.

Why is Energy Storage Innovation Important?

Because of the scientific realities of renewable energy:

Renewable energy sources like wind and solar provide clean, sustainable electricity, but only when the sun shines or the wind blows. Their generation varies, can be unpredictable, and changes much more rapidly than that of fossil-fueled power plants. Energy storage can help grid operators and utilities take full advantage of abundant renewable energy while providing reliable electricity.

Because of the modern realities of energy use:

The increasing use of everything from plug-in devices and electronics to electric vehicles has made demand less predictable as well, and grid operators must account for variable generation provided by sources like solar and wind. Energy storage helps grid operators match supply with changing demand.

Because of California's unique energy vision:

A vision for a clean energy future has been crafted in California. By setting goals for increasing renewable energy and reducing emissions, the Renewables Portfolio Standard and other energy policies increased the importance of applying energy storage on the grid.

What Challenges Face Energy Storage?

A wide range of technical challenges, financial uncertainties, and regulatory and market complexities must be resolved for energy storage to scale up within California's energy markets. Energy storage must be cost-effective and the technologies mature before it will succeed. Research, development, and demonstration (RD&D) help clear these hurdles.

How Does RD&D Address These Challenges?

By supporting technology demonstrations and bringing energy storage innovators and investors together, Energy Commission RD&D projects provide data and real-world experience that will help bring down costs and prove which solutions work best in specific applications. Demonstration projects also help reduce risk and uncertainty for investors and guide policy plans. The Energy Commission has invested in more than a dozen energy storage demonstration projects since 2010 to strategically explore issues facing a wide range of storage technologies and grid operations.

These four highlighted projects, which represent only a portion of the Energy Commission's storage portfolio, attracted over \$60 million in total match funding to energy storage innovation in California. These leveraged investments included \$18.3 million in one-time American Recovery and Reinvestment Act funds brought to the state.



Testing Ways to Add Sunshine to the Grid While Improving System Reliability

DEMONSTRATIONS WITH PG&E IN VACAVILLE AND SAN JOSE

These large sodium-sulfur batteries provide operational data while helping protect power reliability. RD&D utility-scale tests are giving power suppliers and industry the information they need to trust energy storage.



Using Faster Batteries to Integrate Wind Power in the Central Valley

WITH PRIMUS POWER AT THE MODESTO IRRIGATION DISTRICT

This flow battery project will test this proven, faster-acting, and higher-power technology at power-plant scale: 25 megawatts. The project will store wind power and provide electricity to the grid to stabilize renewable generation.



Proving Value for Customers: In-home Energy Storage and Rooftop Solar Panels

PROJECT WITH SACRAMENTO MUNICIPAL UTILITY DISTRICT

With this project in a Sacramento community, Energy Commission RD&D is testing the real-world value and performance of small-scale advanced lithium-ion batteries at customers' homes. The units store power from rooftop panels and reduce demand at peak hours.



Li-Ion Batteries, Solar Power, and Security: Energy Storage at Santa Rita Jail

PROJECT WITH ALAMEDA COUNTY

This microgrid project integrates solar power with energy storage, ensuring that the facility's essential power needs are met even during grid outages. Secure, local, independent smart grid power relies upon energy storage.

FOR MORE INFORMATION please contact Avtar Bining, Ph.D, (916) 327-1411, or avtar.bining@energy.ca.gov

Edmund G. Brown Jr.
Governor

Robert B. Weisenmiller
Chair

Commissioners
Karen Douglas
David Hochschild
Andrew McAllister
Janea A. Scott



CALIFORNIA
ENERGY COMMISSION

CEC-500-2013-F5-009